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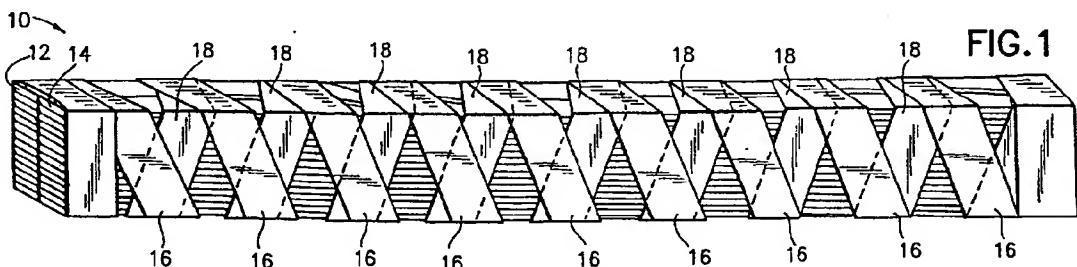
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(54) **A multiple parallel conductor featuring conductors partially wrapped with an aramid or other suitable wrapping material**

(57) The invention provides a multiple parallel conductor for windings of electrical motors, including transformers, having individual insulated partial conductors with at least five partial conductors or transposed conductors. The multiple parallel conductor features a material that is partially wrapped about the individual insu-

lated partial conductors for allowing cooling fluid to pass through the individual insulated partial conductors. The material is partially wrapped about the individual insulated partial conductors in a helical configuration. In one embodiment, the material is an aramid material such as Nomex™.



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Description

BACKGROUND OF THE INVENTION

1. Field Of The Invention

[0001] The present invention relates generally to a multiple parallel conductor for windings of electrical machines; and more particularly to continuously transposed cable ("CTC") conductors having individual insulated partial conductors with at least five partial conductors or transposed conductors.

2. Discussion of Related Art

[0002] In the prior art, multiple parallel conductors are known for windings of electrical machines. A typical electrical transformer coil comprised of continuously transposed cable ("CTC") conductors having individual insulated partial conductors with at least five partial conductors or transposed conductors is held together in a bundle by completely wrapping the conductors with multiple layers of material such as paper, Nomex™, or other suitable wrapping medium.

[0003] However, one disadvantage of such designs is that the completely wrapped conductors trap layers of stagnant cooling fluid which reduces the heat transfer rate, resulting in decreased conductor cooling efficiency. The completely wrapped conductors have an additional disadvantage in that they absorb cooling fluid such that the cross-sectional area is increased, reducing the cooling channel cross-section and thereby reducing cooling efficiency.

[0004] International Application No. WO 95/30991 teaches the use of polyester and/or fiberglass mesh to hold conductors in place, and also permits cooling fluid to pass from one side of the mesh to another, thereby cooling the conductors more efficiently.

SUMMARY OF THE INVENTION

[0005] The present invention features partially wrapping the conductors of a multiple parallel conductor with a material such as Nomex™ 410, or other material with a suitable tear and longitudinal strength and transformer oil compatibility.

[0006] In one embodiment, the conductors of a transformer are partially wrapped, using a suitable wrapping medium, so that the conductors are only partially covered. In a preferred embodiment, the wrapping medium would cover a portion of the coil, depending on the desired amount of cooling.

[0007] There are several advantages to the design of the present invention. By partially wrapping the conductors, cooling fluid will not be trapped within the wrapping medium. In addition, by partially wrapping the conductors, the amount of material is reduced when compared to a transformer utilizing multiple layers. Other advan-

tages may also include: enhanced conductor size and electrical machine cooling; reduced coil size; possible reduced machine size and reduced cooling duct obstructions.

5 [0008] Other objects and advantages of the present invention will become apparent to those skilled in the art from the following detailed description read in conjunction with the attached drawings and claims appended hereto.

BRIEF DESCRIPTION OF THE DRAWING

[0009] For a fuller understanding of the nature and objects of the invention, reference should be made to the following detailed description taken in conjunction with the accompanying drawing, not drawn to scale, in which:

FIGURE 1 is a perspective view of a multiple parallel conductor that is the subject matter of the present invention;

FIGURE 2 is a side view of the multiple parallel conductor shown in **FIGURE 1**:

FIGURE 3 is a top view of the multiple parallel conductor shown in FIGURE 1; and

25 FIGURE 4 is a diagram of a cross-sectional view of the multiple parallel conductor shown in FIGURE 2 along lines 4-4.

30 DESCRIPTION OF THE BEST MODE OF THE
INVENTION

[0010] FIGURES 1-4 show a multiple parallel conductor generally indicated as 10 for windings of electrical motors, including transformers, having individual insulated partial conductors with at least five partial conductors or transposed conductors indicated as 12, 14. As best shown in FIGURES 1 and 14, the multiple parallel conductor may include 14 partial conductors or transposed conductors like 12, 14 that crossover one another, similar to that shown in International Application no. WO 95/30991, discussed above. In one embodiment, the individual insulated partial conductors with at least five partial conductors or transposed conductors 12, 14 may be insulated with lacquer. However, the scope of the invention is not intended to be limited to any particular size, shape, number, type of insulation material or other relationship of the conductors.

[0011] As shown, the multiple parallel conductor 10 has a material generally indicated as 16, 18 that is partially wrapped about the individual insulated partial conductors for allowing cooling fluid to pass through the individual insulated partial conductors. As discussed above, by partially wrapping the conductors, the amount of material (such as Nomex™) used is reduced when compared to a transformer utilizing a complete wrap of the material.

[0012] The material 16, 18 used may be an aramid material, or other suitable wrapping material. The scope

of the invention is clearly intended to cover other types of aramid materials, and may also include any of a group of lightweight but very strong heat-resistant synthetic aromatic polyamide materials that are fashioned into fibers, filaments, or sheets and used especially in textiles and plastics.

[0013] The material 16, 18 is partially wrapped about the individual insulated partial conductors in a helical configuration, as best shown in FIGURES 1-3. As shown, the material 16, 18 partially covers about 50% of the individual insulated partial conductors although the scope of the invention is not intended to be limited to that particular percentage. For example, embodiments are envisioned in which 30% or 70% of the individual insulated partial conductors are partially covered by the material 16, 18.

[0014] Although the present invention has been described with respect to one or more particular embodiments of the apparatus, it will be understood that other embodiments of the present invention may be made without departing from the spirit and scope of the present invention. Hence, the present invention is deemed limited only by the appended claims and the reasonable interpretation thereof.

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electrical motors, including transformers, having individual insulated partial conductors with at least five partial conductors or transposed conductors (12, 14),

characterized in that the multiple parallel conductor (10) includes an aramid material (16, 18) such as Nomex™ that is partially wrapped around the individual insulated partial (12, 14) conductors in a helical configuration for allowing cooling fluid to pass through the individual insulated partial conductors (12, 14).

7. A multiple parallel conductor (10) according to claim 6, characterized in that the material (16, 18) is partially wrapped about the individual insulated partial conductors (12, 14) in a helical configuration.

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Claims

1. A multiple parallel conductor (10) for windings of electrical motors, including transformers, having individual insulated partial conductors (12, 14) with at least five conductors (12, 14),
characterized in that the multiple parallel conductor (10) includes a material (16, 18) that is partially wrapped about the individual insulated partial conductors (12, 14) for allowing cooling fluid to pass through the individual insulated partial conductors (12, 14).
2. A multiple parallel conductor (10) according to claim 1, characterized in that the material (16, 18) is an aramid material such as Nomex™.
3. A multiple parallel conductor (10) according to claim 2, characterized in that the material (16, 18) is partially wrapped about the individual insulated conductors in a helical configuration.
4. A multiple parallel conductor (10) according to claim 1, characterized in that the material (16, 18) is partially wrapped about the individual insulated conductors (12, 14) in a helical configuration.
5. A multiple parallel conductor (10) according to claim 1, characterized in that the material (16, 18) partially covers the individual insulated conductors (12, 14).
6. A multiple parallel conductor (10) for windings of

FIG. 1

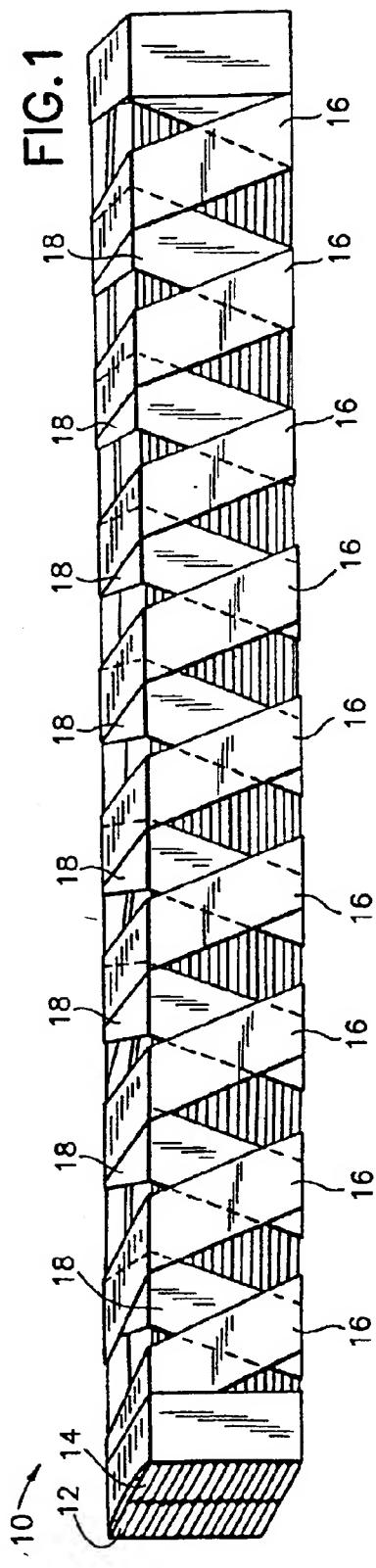
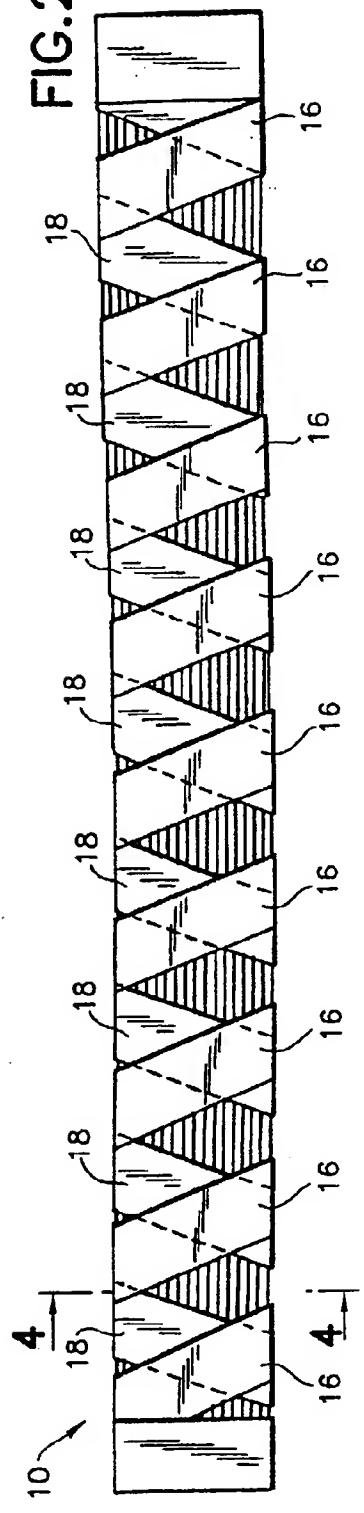
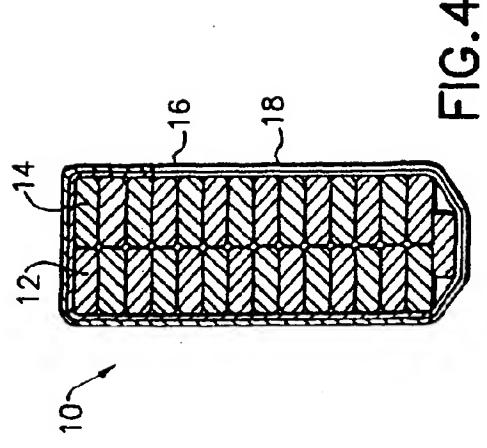
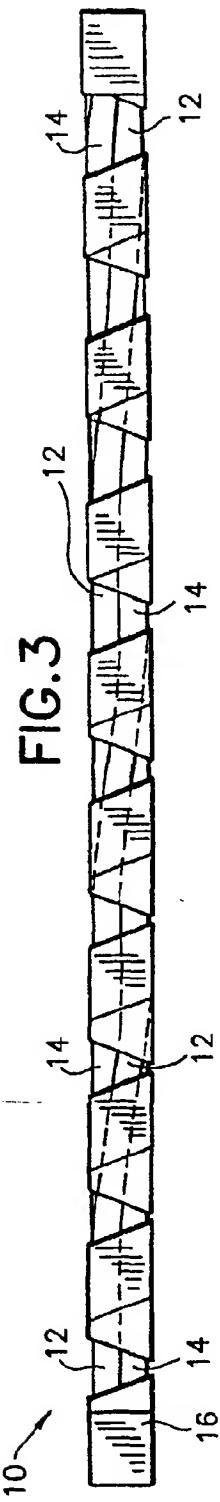


FIG. 2









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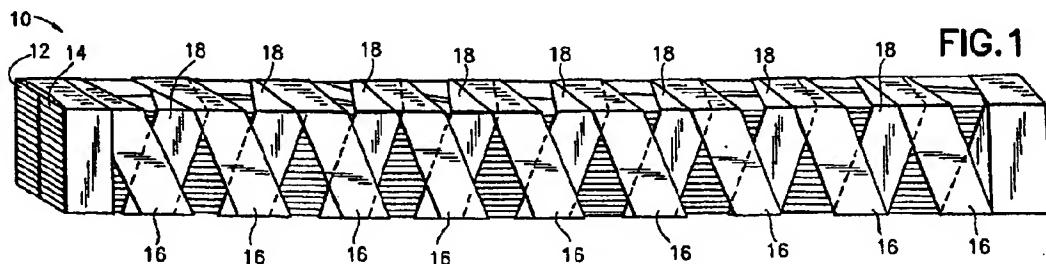
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EUROPEAN SEARCH REPORT

Application Number
EP 99 40 1174

DOCUMENTS CONSIDERED TO BE RELEVANT			CLASSIFICATION OF THE APPLICATION (Int.Cl.6)
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	
Y,D	WO 95 30991 A (ASTA ELEKTRODRAHT GMBH) 16 November 1995 (1995-11-16) * claim 1 * * figure 1 * -----	1-7	H02K3/34 H02K3/14 H02K3/24 H02K3/32
Y	DE 16 14 582 A (SIEMENS) 23 December 1970 (1970-12-23) * page 5, line 3 - line 16 * * figures 4-7 * -----	1-7	
			TECHNICAL FIELDS SEARCHED (Int.Cl.6)
			H02K
<p>The present search report has been drawn up for all claims</p>			
Place of search BERLIN	Date of completion of the search 28 November 2000	Examiner Foussier, P	
CATEGORY OF CITED DOCUMENTS		T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document	
<small>EPO FORM 16C2 03 82 (P04C01)</small>			

**ANNEX TO THE EUROPEAN SEARCH REPORT
ON EUROPEAN PATENT APPLICATION NO.**

EP 99 40 1174

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report.
The members are as contained in the European Patent Office EDP file on
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28-11-2000

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WO 9530991	A	16-11-1995	AT 1802 U AT 154465 T DE 59500312 D EP 0746861 A	25-11-1997 15-06-1997 17-07-1997 11-12-1996
DE 1614582	A	23-12-1970	SE 336169 B	28-06-1971

EPO FORM P0459
For more details about this annex : see Official Journal of the European Patent Office, No. 12/82